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AGRICULTURAL NEWS LETTER

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This publication contains information regarding new developments of interest to agriculture based on laboratory and field investigations of the du Pont Company and its subsidiary companies. It also contains published reports and direct contributions of investigators of agricultural experiment stations and other institutions as related to the Company's products and other subjects of agricultural interest.

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Vol. 8 - No. 5 Sept.-Oct., 1940

AGRICULTURAL NEWS LETTER

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Agricultural News Letter (Du Pont)
Vol. 8 - No. 5. Sept.-Oct. 1940.

WISCONSIN EXPERIMENTS ON FEEDING UREA TO DAIRY CATTLE

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EDITOR'S NOTE: The problem of the efficient utilization of simple nitrogenous compounds, such as urea, by dairy cattle has been studied in Europe where protein concentrates are expensive. The European results are conflicting and inconclusive. Convinced that only long-time experiments, involving determinations of growth and milk production, could give conclusive data, the University of Wisconsin Agricultural Experiment Station in 1936 began a series of such experiments. Preliminary results were first published by E. B. Hart, G. Bohstedt, H. J. Deobald, and M. I. Wegner, in the 1938 "Record of Proceedings of the American Society of Animal Production", and in more detail in the "Journal of Dairy Science", October, 1939. (Reprints of these papers will be sent on request.) Additional data on subsequent experiments, prepared by I. W. Kupel, Bohstedt, Wegner, A. N. Booth, and Hart for early publication in the Station's "Annual Report", have been made available to the Ammonia Department of the du Pont Company, which is helping finance the investigations under a special research grant. A brief summary of the results to date follows.

Experiments have been conducted at the University of Wisconsin Agricultural Experiment Station since 1936 to determine whether cattle can utilize urea for part of their requirements of protein nitrogen.

Experiments With Growing Calves

The first two experiments involved the utilization of urea and ammonium bicarbonate nitrogen with 12 growing Holstein calves -- four males and six heifers.

First Experiment With Four Male Calves: The first experiment involved four male calves which were fed a ration of yellow corn 19.5 pounds, starch 20, ground timothy hay 47, steamed bone meal 2, iodized salt 1, and cod liver oil 0.5. This ration contained a little less than 6 per cent of total protein. Growth was slow. When to this ration there were added 4.3 pounds of urea per 100 pounds of ration, 11.1 pounds of ammonium bicarbonate, or 11 pounds of casein, thereby bringing the protein to a level of 18 per cent, better growth was obtained. It was evident from the growth records alone that these animals were making use of the simple forms of nitrogen. However, additional proof was obtained when the four animals were slaughtered and the amount of stored protein in the carcasses determined. By taking the increment in weight and the amount of protein in each calf, it was found that over the entire period of

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the experiment the control animal stored 35 pounds of protein, the urea animal 61.5, the ammonium bicarbonate 55, and the casein animal 86 pounds.

Second Experiment With Six Heifers: A second experiment was started with six heifers which were fed a modification of the previous basal ration. This ration consisted of 20 pounds yellow corn, 47.5 ground timothy hay, 24 starch, 10 corn molasses, 2 steamed bone meal, 1 salt, and 0.5 cod liver oil, as shown in Figure 1. This modification was made in the hope that it would not give growth but only maintenance, which proved to be the case, as shown by the growth record of Animal No. 1.

A study of the growth records in Figure 1 show that all of the animals, except the one fed only the basal ration, grew from the start of the experiment. Calf No. 1, however, did not change in gross weight for 12 weeks. At the end of the 12 weeks, this animal's basal ration was fortified with 1.4 pounds of urea per 100 pounds of ration. Immediately there was a resumption of growth, appetite improved, and the animal continued to grow quite as well as the casein animal. The animal receiving 1.4 pounds of urea (43 per cent of the nitrogen of the ration as urea) grew from the start quite as well as the casein calf. These two calves offer a clear example of the utilization of urea nitrogen.

The experiments with the growing calves show that with urea nitrogen constituting 43 per cent of the nitrogen in the ration, the growth rate was only slightly less than that secured with a ration containing 66 per cent of its nitrogen as casein nitrogen. This does not imply that urea nitrogen in the ration used is superior to casein nitrogen.

Analysis of the tissues at the end of the experiment indicated that the increments in weight with urea or ammonium bicarbonate nitrogen were of normal composition with a protein content similar to that of the casein-fed animal. Extractable non-coagulable nitrogen was no greater in the leg tissues of the urea or ammonium bicarbonate animal than in the tissues of the casein animal.

The kidneys were removed and examined at the time of killing. The only animal showing any hypertrophy of the kidney or evidence of kidney lesions was No. 4, which received 4.3 pounds of urea in 100 pounds of ration. This animal showed considerable diuresis. Animal No. 3, which received 2.8 pounds of urea, showed slight but definite evidence of damage to kidneys. Animal No. 1, which received 1.4 pounds of urea, showed perfectly normal kidneys and no hypertrophy. Since, on any low-protein ration such as the one used in this experiment, not more than 3 pounds of urea per 100 pounds of grain mixture would be needed, the urea would actually constitute about 1 pound in 100 pounds of the entire ration. This is the amount being used in the milk experiments to be discussed later. The Wisconsin report, discussing this point, says: "We would not anticipate, if urea feeding should come into practice and the levels indicated were used, that there would be any damage whatever to the kidney."

Conclusions Regarding Growing Calves: It will, therefore, be seen that the information developed in the first two experiments show that urea can be used as a source of nitrogen of the ration, and that the tissues produced are entirely

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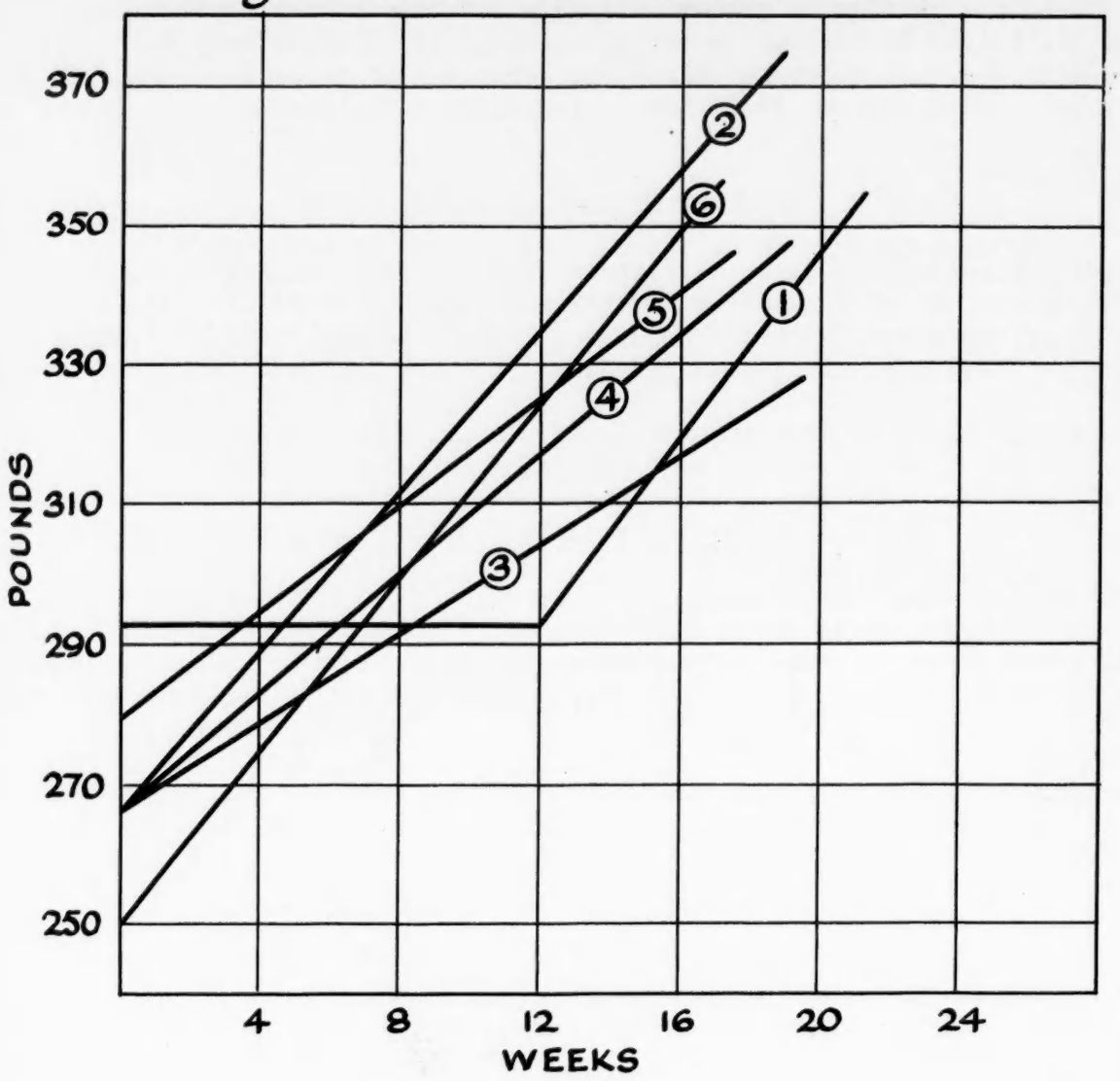
Figure 1.—Growth of Heifer Calves



Animal	Ration
No. 1	Basal for first 12 weeks. Basal plus 1.4 lbs. urea thereafter.
No. 2	Basal plus 1.4 lbs. urea (43% of total nitrogen).
No. 3	Basal plus 2.8 lbs. urea (61%).
No. 4	Basal plus 4.3 lbs. urea (70%).
No. 5	Basal plus 11.1 lbs. ammonium bicarbonate (69%).
No. 6	Basal plus 11.0 lbs. casein (66%).

Basal ration consisted of 20 lbs. yellow corn, 47.5 ground timothy hay, 24 starch, 10 corn molasses, 2 special steamed bone meal, 1 salt, and 0.5 cod liver oil. This ration contained 5.38 per cent total nitrogen.

Equalized feeding was practiced throughout the entire experiment. Weather permitting, calves were turned out daily in a vegetation-free paddock.

normal. The published reports state that "the experiments indicate definitely that such nitrogen can be used for a partial supply of protein nitrogen". They add that "the most probable explanation is the production of protein by bacterial cell multiplication in the rumen and later digestion in the fourth stomach and intestine". Subsequent studies, mentioned later in this paper, support the foregoing hypothesis.

Experiments With Dairy Cows

It is generally assumed that where growth occurs, milk production will be normal. With this in mind, the University of Wisconsin, in the Spring of 1939, bought 24 fresh Holstein cows, and began a 3-year experiment to determine whether urea can be substituted for protein concentrates.

The basal ration consisted of corn silage, timothy hay, and equal parts of corn and oats. Iodized salt and bone meal were also provided. The grain contained about 10 per cent of total crude protein, which is considered too low where timothy hay and corn silage constitute the roughage.

The cows were divided into four groups of six each on the basis of their milk production. At the beginning of the experiment, each group was producing approximately 1,485 pounds of 4% milk per week. The results for 33 weeks of the first lactation period are shown in Figure 2, which gives milk production; and Figure 3, which shows rate of decline in milk production.

In the experiments, the cows were milked by machine twice daily. Complete records were kept on food consumption and milk production. Over a period of 33 weeks, Group 1 (basal ration) produced 28,730 pounds of 4% milk; Group 2 (urea), 34,270; Group 3 (urea) 31,707; and Group 4 (oil meal) 33,758.

On the basal ration, fat production was lower than on the other rations, but the percentage of fat in the milk of the basal ration was also consistently lower. It averaged about 2.8 per cent, while on the other rations it was always 0.2 to 0.3 per cent higher.

During the course of the experiment, analyses were made of the milk, particularly as to the per cent of protein. No differences were found in the protein content of the milk produced by the four groups. In Group 1, after the cows had been on the ration for three to four months, the protein content averaged 2.59; in Group 2, 2.61; in Group 3, 2.64; and in Group 4, 2.73.

Conclusions Regarding Dairy Cows: The data in Figures 2 and 3, for the first lactation period, show that urea functioned fully as well as oil meal in milk production on the basal ration used. There were no disturbances observed from urea feeding that would appear to make it in any way objectionable.

General Conclusions

While there are many intricate ramifications to this problem, as will be shown when details of all the experiments and supplementary studies are published in full, the results of four years of research at Wisconsin, involving a number of separate experiments, indicate definitely that urea can be used for at least

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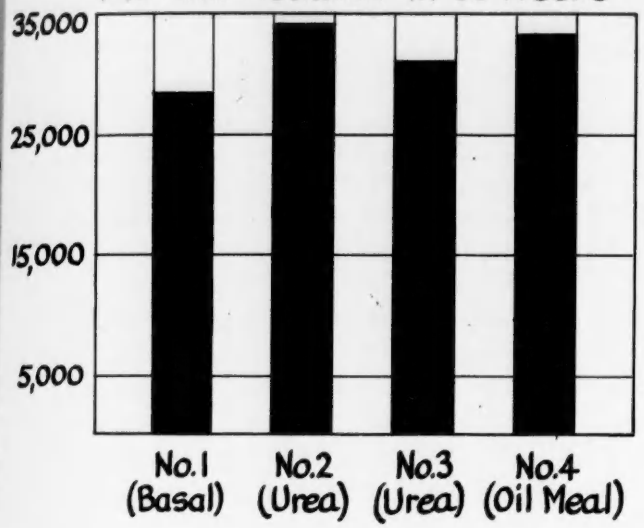
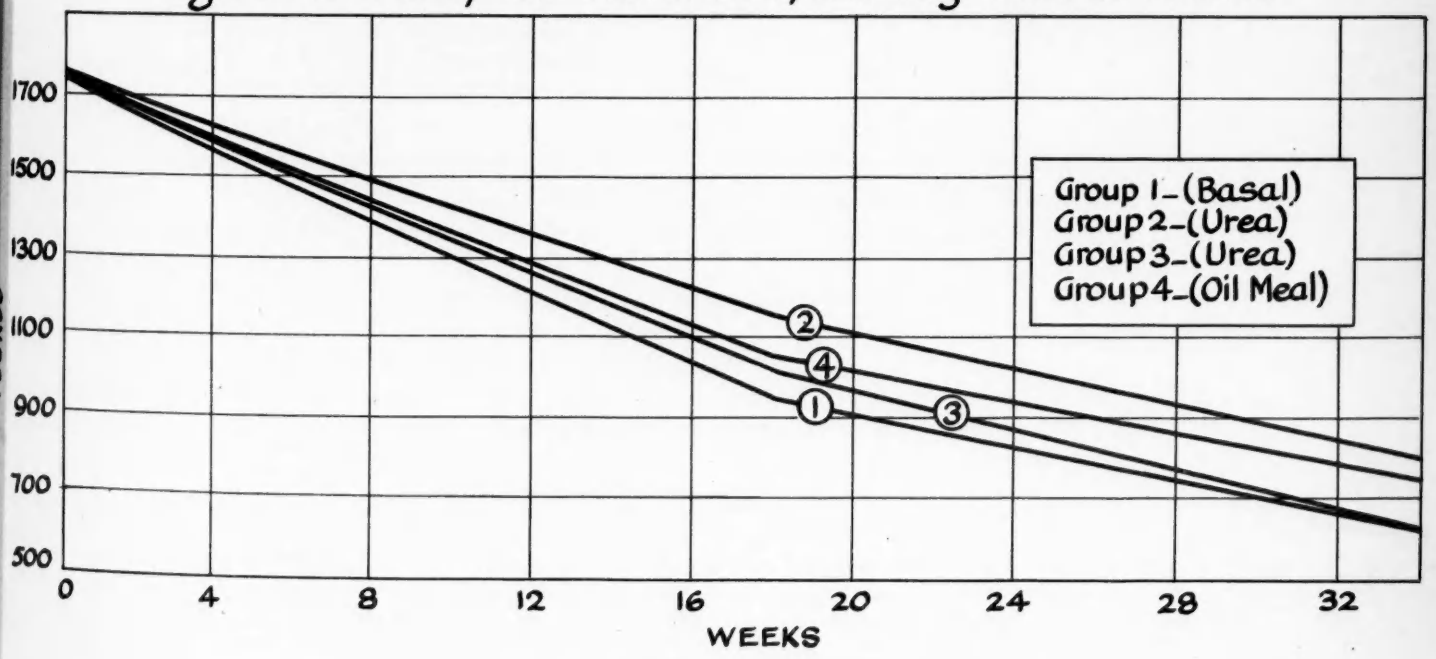
Figure 2.—Total Amount of 4% Milk Produced in 33 Weeks



Group*	Ration
No. 1	Basal ration, recognized as too low in protein. Roughage: corn silage and timothy. Grain mixture contains about 10% total crude protein
No. 2	Basal plus 3 lbs. urea added to 97 lbs. grain mixture, making nitrogen content of grain mixture equivalent to 18% protein.
No. 3	Same as Group 2.
No. 4	Basal plus linseed meal in such proportion to make protein content of grain mixture equivalent to 18%.

*Six cows in each group.

Figure 3.—Weekly Milk Production, Showing Rate of Decline



a partial supply of protein nitrogen in the diet of growing calves and as a substitute for protein concentrates in the diet of mature milk cows in production.

Additional Useful Information

As indicated in the foregoing paragraph, much supplementary work is being conducted in connection with these experiments. These additional studies are developing a variety of useful related information bearing on the use of urea in the diet of cattle. For instance, expert "tasters" found that there was no consistent difference in the flavor of milk from cows receiving urea and those receiving oil seed meal. In fact, the records show a somewhat but not significantly superior flavor from cows receiving urea. Another interesting observation was the lowered content of vitamin C in the milk of the cows receiving the basal ration.

Another important factor is the effect of the various diets on production of calves. When the cows began to drop their calves in the Spring of 1940, nothing unusual occurred with respect to size of calves, nor was there any udder trouble. There were no abortions, although two mummified calves were produced on the basal ration. The two cows that produced these calves were re-bred for their second lactation. No unusual difficulties were experienced in re-breeding the cows under these systems of feeding.

In supplementary experiments, studies were made to test the hypothesis of inorganic nitrogen utilization in ruminants via rumen bacteria. The Wisconsin workers report that these "in vitro" studies show that "synthetic media carrying a proper carbohydrate-salt mixture and inoculated with rumen organisms and maintained with calcium carbonate at the proper pH will lead to a rapid growth of bacterial cells accompanied by an elaboration of bacterial proteins from these simple nitrogen materials."

These same workers, in reporting "in vivo" studies on protein synthesis state that, through the fistula* of a heifer, data are now being accumulated on what goes on chemically in the rumen when the cow is fed the basal ration as well as modifications on this basal ration. They add:

> "Preliminary studies indicate that on the basal ration, consisting of corn silage, timothy hay, corn and oats, there is a rapid digestion of the starch in the rumen with loss of the sugar produced and a slow rise in the fat, protein and fiber of the rumen contents. When to this basal ration urea is added, the same general phenomena occur as on the basal ration, but with a greater rise in the protein percentage in the rumen content. Hourly analyses after ingestion of the ration with urea showed that within an hour the urea is all converted to ammonia and within four to five hours all the ammonia has disappeared -- presumably into bacterial proteins."

This work is being extended with a variety of rations and especially lower protein rations. Instead of using the grains, starch is being used in an effort qualitatively to accentuate the difference between protein content of the rumen on the low protein intake as compared with the low protein ration plus urea.

*Artificial opening which permits sampling rumen contents.

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Agricultural News Letter (Du Pont)
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NEW SOUND-AND-COLOR MOTION PICTURE OFFERED

Du Pont Film, "A New World Through Chemistry," Follows Chemical Products from Laboratory to Home or Wardrobe; Available for Showing to Clubs, Schools.

A new sound-and-color motion picture, "A New World Through Chemistry," has been released by the Public Relations Department of the Du Pont Company.

The film interprets, in 20 minutes of narration and ingenious photography, many of chemistry's newest developments. Nylon textile fiber and nylon hosiery, plastics, dyestuffs, "Zelan" durable water repellent, rayon and other chemical contributions to modern living are shown, the picture tracing their evolution from the laboratory through processes of manufacture and into actual use. Part of the action was screened in Hollywood, employing professional models.

Many sequences of the picture have never before been filmed. Settings include a number of Du Pont laboratories and plants, showing how products such as nylon are made. Other scenes were filmed in the plants of Du Pont customers who convert the materials into household and personal necessities. The Hollywood scenes demonstrate practical everyday uses of the products shown.

"A New World Through Chemistry" was produced by Scientific Films, Inc., in full Cinecolor. The script, written by Walter Anthony, is narrated by Gayne Whitman with musical arrangements by Edward Paul.

The picture is offered for club and school showing through the Du Pont Company's Motion Picture Bureau. It may be borrowed either in 16-mm size on an 800-ft. reel or 35-mm size on a 2000-ft. reel. There is no charge except the cost of returning the film.

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Agricultural News Letter (Du Pont)
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FORMALDEHYDE AND STEAM MIXTURE FOR STERILIZING GREENHOUSE SOIL.

An Effective, Economical Means of Controlling Wilt and Club Root Reported.

A new sterilization method for the control of wilt and club root in greenhouse soil, now being used by four growers near Toledo, Ohio, is described as unusually effective. The process, as applied by the Slayton Greenhouse Company, one of the four, is based on the admixture of formaldehyde with steam, and passage of the hot mixture up through the bed. The other three growers using the method are the Wendell Kern Greenhouse Company, Norman J. Meyer and J. E. Eubank.

The cost is reported to be materially lower than the conventional treatment with steam alone, and requires only one-third the time. In addition, the Slayton Company describes their house as the "cleanest it has ever been" with respect to wilt and club root. Only one treatment a year, between spring and fall crops, is normally required. The procedure is a modification of that described in Bulletin 348, May 1937, by Pennsylvania State College, School of Agriculture and Experiment Station.

W. L. Slayton, proprietor of the company, utilizes piping tile formerly employed for steam treatment alone. Formaldehyde and steam are introduced below the surface of the soil, thus combining the advantages of heat, steam, moisture and hot formaldehyde. Uniform dissipation of the formaldehyde through the bed is reported. Changing of the soil is unnecessary.

The Slayton Greenhouse Company has 4½ acres under glass. The beds are 338 feet by 14 feet, filled to a depth of about 1 foot over tile. They are piped for steam in the accepted manner, each bed being supplied by a 2 inch line from a 4 inch main.

The apparatus for adding formaldehyde is connected to the 2 inch steam line. It consists of a reservoir for the formaldehyde with suitable means for bleeding the chemical into the stream. The reservoir, a vertical cylindrical vessel made of steel casing, is 8 inches in diameter, 18 inches high, and holds 28 pounds of solution.

At the top, a 1½-inch pipe with a gate valve is used for filling the container. At the bottom a 1/2 inch pipe with valve allows the formaldehyde to drain into the 2-inch steam line. A 1/4-inch pipe with valve runs from the steam line to a point inside the cylinder above the liquid line and serves to equalize pressure. A sight glass on the reservoir enables the operator to observe the rate at which formaldehyde is added to the steam and to determine when the process is completed. The apparatus could be modified considerably without decreasing its effectiveness, it is stated.

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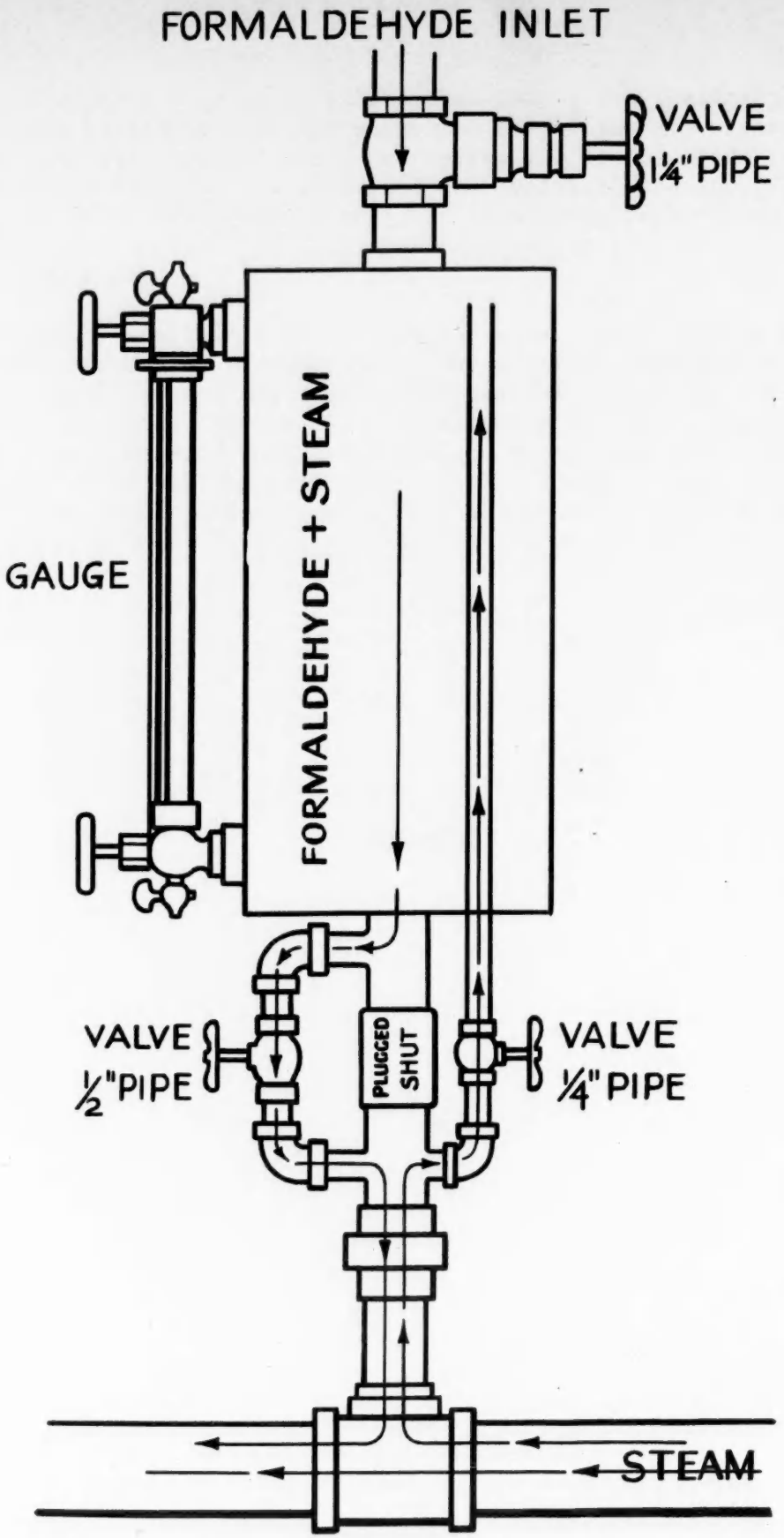

DIAGRAM.

Diagram shows layout of new formaldehyde steam process employed in wilt and club root control.

The beds are covered with rubberized canvas before the treatment is started. To operate the equipment, the two valves at the bottom are closed and the formaldehyde solution poured into the reservoir. If the steam is not already flowing in the steam line, it is turned on. Valve at the top of the reservoir is closed, valve on the 1/4 inch pressure equalizing pipe opened and valve on the 1/2-inch pipe cracked to allow the formaldehyde solution to drain slowly into the steam line.

The old method of sterilization, in use for many years, employs steam alone as the agent. According to Henry Truelson, manager, this procedure required from 8 to 15 hours, consuming some 7½ carloads of coal. The new process requires only four hours. Steam alone is used for the first three hours while during the last hour formaldehyde is admixed with steam at the rate of 100 lbs. per bed. The total cost of materials is about equal to the cost of 4½ carloads of coal. Actual coal consumption is only 3½ carloads, but the cost of the required amount of formaldehyde is about equivalent to that of one carload of coal.

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RESEARCH SHARPENS THE FARMERS' KNIVES

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A continuous research program in the laboratories of the Remington Arms Company at Bridgeport, Conn., is producing what every farmer needs and has long wanted ----a supply of knives designed for the special requirements of the farm and able to "hold their edge" under truly punishing conditions.

Sharpness and more sharpness has been the steady goal of the research workers. Exacting methods of testing sharpness have been developed. An instrument which has proved extremely useful in this work reports on the keenness of a cutting edge by the way the knife slices through paper.

The paper is carefully standardized as to thickness and strength. It is then stacked in a pile of accurately counted sheets. The knife is bolted into a slot over the pile so that it can be brought down mechanically at an even speed and under controlled pressure. The precise cutting rate of the blade is recorded automatically on a chart attached to the instrument.

Results of the tests are plotted on charts. Detailed records are kept. The exact data obtained by means of this mechanical slicer permit the research worker to study the durability as well as the sharpness of the edge.

Effects of edge angles and blade shapes are precisely determined with this device, which also has proved useful in efforts to develop ideal methods of sharpening blades. Cutting and edge holding properties of a large number of steel alloys after various types of heat treatments have been accurately rated by means of tests on the device.

But paper slicing is only one test to which the farm knives are subjected. The Remington research program includes detailed study of the performance of knives on the materials which they will meet in actual use.

Heavy duty cutlery has always held a position of high importance among the farmer's indispensable tools. But in spite of his need of special knives for special purposes, he formerly had to be content with "any old knife" that could be made to serve. Often, indeed, the farmer's personal jackknife was the all-purpose instrument.

Farmers began to get vocal about the situation 75 years ago. They demanded knives suited to their special needs and they demanded good knives. American manufacturers made a study of these needs and began to design a whole new assortment of knives to meet them. In the succeeding years, the production of knives especially for farm use has expanded steadily.

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As the first step, the manufacturers worked out two basic designs. One came to be known as the "cattle knife"; the other, as the "premium stock knife." Both designs have the same general type of blading. The cattle knife, however, has an "equal end" and is slightly heavier. The premium stock knife is curved and more slender.

Three sizes of blades have been provided for each of the two general types. One size is known as the "master blade" and is used for the heaviest cutting. Another is called the "sheep-foot knife" from its resemblance to a sheep's foot. It is used extensively for cleaning and trimming hooves. The third is the "spay blade," especially designed for the delicate operation of castrating.

To this selection of designs has been added the "punch blade." This is an extremely useful knife for cutting round holes in leather and repairing harness.

A special butcher knife also has been designed for farm requirements and is now in general use. Ordinary butcher knives are usually too light for farm use. The chief reason is that the farmer frequently grinds and resharpens the knife himself. This operation, together with the constant hard usage that is the lot of a farm knife, wears an ordinary blade down to nothing very quickly.

Seeking to give the farm butcher knife maximum durability, manufacturers reverted to the early "hammersmith" type of blade. On this knife, the marks of the hammer in the forging operation are left on the finished blade. Grinding is carried half way up the blade, leaving plenty of blade stock for the farmer to grind to the thickness he desires.

The finest quality high carbon steel is now being used for these knives, which are put through a special hardening and tempering process and are hand sharpened for the keenest possible cutting edge. They are fitted with highly polished rosewood, walnut, hickory, and beechwood handles.

The types of butcher knives now in general use include the standard spear shape, the scimitar-like skinning knife, the straight topped boning knife, the dagger-like sticking knife, and the sharply curved steak knife.

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Agricultural News Letter (Du Pont)
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A NEW ECONOMIC CHEMICAL FOR THE FRUIT INDUSTRY

By-

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"P A R M O N E"
(A Hormone Type Harvest Spray)

Editor's Note: During the last half century volumes of information have been published on, and many economic products have been developed for, insect pest and disease control of fruit and other crops.

Insect and fungus control still remains a very active subject as an economic factor in fruit growing, but scientists were familiar with a different type of economic waste caused by the annual heavy preharvest drop of several important varieties of apples.

After midsummer numerous insect- and disease-free apples may be seen on the ground under the trees in the orchard. They are usually badly bruised, decay rapidly, and in most cases become hardly fit for the hogs. At best the return from the disposal of these drops or culls is significantly small.

Early efforts by good orchardists to avoid this preharvest drop forced them to pick their fruit before satisfactory size, color and maturity developed. Naturally, such fruit was not to the public's liking and demand lessened, again causing lower financial returns. The following article outlines recent developments in the use of Hormone Type Harvest Sprays.

Experimenters working with plant growth stimulants, usually referred to as plant hormones, found two chemical compounds - naphthalene acetic acid and naphthalene acetamide - to be of value for preventing these preharvest losses.

At the end of 1939, the U. S. Department of Agriculture published the results of one year's experimental work. This information spread rapidly to all fruit-growing areas and a definite demand was created for commercial products based on the results of the experimental work.

We quote herewith a review of this subject, entitled "SPRAYING TO CONTROL PREHARVEST DROP OF APPLES", by Dr. L. P. Batjer, Bureau of Plant Industry, U. S. Department of Agriculture.

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"Losses resulting from preharvest drop of apples have long been a serious problem with many growers. So likely is a grower to lose a considerable proportion of his crop from dropping, that it is often necessary to harvest some varieties before they have attained satisfactory color and maturity. Many McIntosh growers are forced to resort to a compromise between satisfactory color and loss from dropping. 'If they would stay on the tree a few more days, color would improve but we can't afford to take the chance of losing from a quarter to half the crop from dropping,' is a familiar remark of many growers of bad dropping varieties.

"Considerable interest has been shown in the new so-called hormone sprays found to be effective by the Bureau of Plant Industry, U. S. Department of Agriculture, in preventing or stopping the preharvest drop of apples. It is the purpose here to outline briefly the development of these sprays and what can be expected of them based on the experimental evidence to date.

"Out of a number of substances generally classified as plant hormones or plant growth substances which were tested at the U. S. Horticultural Station, Beltsville, Md., two chemical compounds, naphthalene acetic acid and naphthalene acetamide, proved to be outstandingly effective in reducing preharvest drop. The quantity of these materials required to control drop is so slight as to be almost unbelievable. Concentrations of .0005 percent to .001 percent were found to be completely effective when properly and timely applied. A .001 percent is equivalent to a weight of 4 grams (about one teaspoonful) in 100 gallons of water. A spray stronger than the above is likely to "stick" the fruit so tightly that difficulty will be encountered in picking since spurs may be broken off or stems pulled from the fruit. In all of the experimental work at this Station the pure hormone has been used. The correct amount of naphthalene acetic acid or naphthalene acetamide has been weighed out, dissolved in a small amount of alcohol and poured directly into the spray tank with the addition of a spreader or sticker, the choice of which seems to be immaterial.

"Since the pure hormones are not readily soluble in water, and due to the impracticability of the grower measuring such small amounts accurately, there are available on the market at the present time several proprietary commercial preparations which are now being advertised and used by orchardists. These commercial preparations consist of a weighed amount of hormone mixed with a powdered filler or liquid solvent designed to facilitate quick solution when added to the spray tank.

"Effective period of hormone spray. All work done thus far indicates that the effective period of the spray for most varieties is from two to three weeks. Tests performed with McIntosh have shown an effective period for only eight to ten days. With varieties having long stems (Williams, Rome Beauty and Delicious) good control of dropping is obtained for three weeks to a month after application. The longer effective period with these varieties is thought to be due to the greater ease with which the spray material contacts the stem and collects in the stem cavity of the fruits. Aside from the variety, it is quite possible that such factors as age, vigor of trees, moisture supply, and temperature conditions will prove to have a bearing on the effectiveness of these sprays as well as their effective period.

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"Because of the relatively brief period of effectiveness, it is important that application be delayed as long as possible, preferably just prior to dropping or soon after its beginning in order to have the effect there when needed most. The material takes effect within one to two days after application.

"Correct timing is extremely important in the case of McIntosh because of the limited effective period. Even eight to ten days of control at the right time would enable many McIntosh growers to get added color and finish without suffering a heavy loss from dropping. With this variety the period of effect ends abruptly, however, and if additional control is desired, it is necessary to re-spray. In general the second spray should follow about seven days after the first.

"Effect of sprays on tree and fruit. There is no toxic or visible residue resulting from these hormone sprays. No injury to fruit, foliage, or the tree in any way has ever been observed. In the case of the fruit the only effect appears to be that of delaying drop, thereby allowing for better color development and some improvement in size. It is quite possible, particularly with summer varieties, to allow the fruit to hang longer than is best for proper maturity. There seems to be no direct effect of the hormone spray on maturity. Many varieties, however, if allowed to hang too long after their normal picking date, are likely to become too mature for best keeping quality. This is of course true whether sprayed with hormones or not."

With this new orchard practice now under extensive experimental test in many fruit sections of the country a number of improvements will doubtless be made and much additional knowledge obtained. In their present form, however, "hormone" sprays, if properly timed and thoroughly applied, will successfully control the preharvest drop of apples. As mentioned above, a number of commercial products containing the active hormone ingredients (naphthalene acetic acid or naphthalene acetamide) are on the market at the present time and the cost is well within practical consideration.

Du Pont experimenters aided in developing a commercial product, which was trademarked "PARMONE". Following the lead and successful results by experimenters, du Pont thought well to adopt the use of the naphthalene acetic acid, which was added to pure di-acetone alcohol, and offered this commercial product in a solution form, similar to that used by experimenters. "PARMONE" is a light-colored liquid which is stable, will not lose its strength on storage, and is not affected by varying temperatures. This product is readily dispersible in water and stays in solution with minimum agitation.

The cost of "PARMONE" to the growers for the 1940 harvest season has been set at $12.00 per gallon. A gallon, when diluted with water, will make up 800 gallons of this Hormone Spray, which ultimately will cost the grower approximately 1-1/2¢ a gallon.

For estimating purposes application generally consists of three-fourths to one gallon of diluted spray per year of growth of the tree, or a 25-year old apple tree will take 20 to 25 gallons of this diluted spray, making the total cost

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of one application approximately 37-1/2¢. This should prevent the customary loss of preharvest drop on an average of one to two bushels per tree at an average selling price for apples at $1.00 per bushel, which clearly indicates the economies derived by orchardists in the use of this spray.

Commercial applications made with these new type sprays have given what might be termed excellent results and indicate increasing use by commercial orchardists.

Experimentation is being continued to develop the economic value of these Hormone Sprays for preventing similar cull losses on peaches, grapes and other types of fruit where losses occur.

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A ROTARY COOLER FOR AMMONIATED FERTILIZERS

EDITOR'S NOTE: Much time and effort of the research staff of the du Pont Company are devoted to experimental activities aimed at developing information which will be useful in helping improve and service products already commercially available. Such research activities often are aimed at development and improvement of methods used by other manufacturers who purchase du Pont products as raw materials. The work discussed below is of special interest to the fertilizer industry as the direct beneficiary, and it is an excellent example of the value and effectiveness of this type of experimental cooperation.

Previous to 1928 practically all commercial fertilizer's containing superphosphates were mixed and stored in bulk piles to complete the slow neutralization reaction between acidic and basic components. If this curing period was not completed, the fertilizer was either caked or in poor physical condition when received by the farmer.

With the advent and continued widespread use of the low-cost ammoniating solutions since 1928, the acid-base reactions in these mixtures were reduced to a matter of seconds rather than days. Of course, a neutralization reaction such as this liberates heat in proportion to the relative weight of ammonia added.

Fertilizer manufacturers have long realized that to take full advantage of the rapid ammoniation reactions, a simple, low-cost method of dissipating the heat developed would go a long way toward helping solve a number of problems. It would not only

1. Remove the heat:

   but in so doing would

2. Reduce reversion of phosphoric acid;

3. Allow use of more ammonia;

4. Improve the condition or "feel" of the goods;

5. Reduce caking in storage; and

6. Save labor when digging down storage piles, as a result of the reduction in "pile set".

The many attempts to dissipate the heat of ammoniation have proved unsuccessful because the methods used did not provide sufficient air or efficient contact

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between material and air. Recently the Ammonia Department completed experimental work which resulted in the development of a small, low-cost cooler that is entirely practicable for cooling ammoniated fertilizers.

It was discovered that a large portion of the heat was removed almost instantly by the evaporation of a small amount of moisture from the hot ammoniated fertilizer. This cooling effect of evaporating moisture is easily demonstrated by wetting one's finger and holding it in front of a fan.

In ammoniated fertilizers around 150°F., between 0.5 and 1.0 per cent moisture can be evaporated. This of itself drops the temperature of the goods 20 to 30 degrees. The air used to carry away this moisture also can remove about the same amount of heat by its own capacity, resulting in a total drop of 40 to 60 degrees. This combined effect and the speed with which the evaporation occurs have reduced the air volume required and have resulted in equipment sizes approximately one-third those indicated by typical drier design calculations. Such a small but efficient cooler consists of three main parts: a cylindrical shell, a fan, and a dust collector, which can be assembled by the fertilizer manufacturer and fitted into his existing plant operations at a comparatively low cost.

General plans and essential design data for the construction of such a cooler have been prepared in folder form, and will be sent upon request to the Ammonia Department of the du Pont Company, Wilmington, Delaware. This folder points out that the removal of heat substantially reduces reversion of phosphoric acid, allows the manufacturer to use more ammonia, improves the condition or "feel" of the goods, and reduces caking in storage.

"The reduction in pile set should result in appreciable labor savings when digging down storage piles", it concludes. "It is also believed that additional caking reduction can be obtained by the increased degree of ammoniation which is made possible with cooling".

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